Prevalence and correlates of recent injecting drug use among Gay and Bisexual Men in Australia: Results from the FLUX study.

Short title (running head): Injecting drug use among gay and bisexual men.

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ABSTRACT

Background: While illicit drug use is prevalent among gay and bisexual men (GBM) in Australia, little is known about the relationship between injecting drug use and sexual risk in this group.

Methods: The Following Lives Undergoing Change (FLUX) study is a national, online prospective observational cohort investigating drug use among Australian GBM. Men living in Australia who were aged 16.5 years or older, identified as gay or bisexual or had sex with at least one man in the last year were eligible to enrol. We used univariate and multivariate log-binomial regression methods to examine associations between socio-demographic and behavioural characteristics and recent (last six months) injecting.

Results: Of 1,995 eligible respondents, 206 (10.3%) reported ever injecting drugs and 93 (4.7%) had injected recently. Crystal methamphetamine was the drug most commonly recently injected (91.4%), followed by methamphetamine powder (9.7%). Only 16 (17.2%) men who recently injected drugs reported injecting weekly or more frequently but one in ten (N=8, 8.6%) reported recent receptive syringe sharing. Recent injecting was associated with lifetime use of more drug classes (adjusted prevalence ratio (APR) = 1.31, 95% Confidence Interval (CI) 1.21-1.41), longer time since initiating party drug use (APR = 1.02, 95% CI 1.01-1.04), greater numbers of sex partners (2-10 sex partners: APR = 3.44, 95% CI 1.45-8.20; >10 sex partners: APR = 3.21, 95% CI 1.30-7.92), group sex (APR = 1.42, 95% CI 1.05-1.91) and condomless anal intercourse with casual partners (APR = 1.81, 95% CI 1.34-2.43) in the last six months.

Conclusions: Observed associations between injecting and sexual risk reflect a strong relationship between these practices among GBM. The intersectionality between injecting drug use and sex partying indicates a need to integrate harm reduction interventions for GBM who inject methamphetamine into sexual health services and targeted sexual health interventions into Needle and Syringe Programs.

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INTRODUCTION

Illicit drug use is prevalent among gay and bisexual men (GBM) in Australia. According to the Australian Gay Community Period Survey (GCPS), between 2004 and 2015, 57% to 72% of GBM reported illicit drug use in the last six months (Hull et al., 2015; Lea, Prestage, et al., 2013). Injecting drug use is more prevalent among GBM than among heterosexual people (Roxburgh, Lea, de Wit, & Degenhardt, 2016). In a 2013 nationally representative sample, 6.2% of participants who identified as lesbian, gay and bisexual (LGB) reported ever injecting drugs compared to 1.3% of heterosexual participants (Roxburgh et al., 2016). LGB participants constituted 2.7% of the sample (including 1.3% GBM and 1.4% lesbian and bisexual women) but represented 11.6% of ever drug injectors (Roxburgh et al., 2016). Between 2001 and 2009, 4.3% - 7.0% of participants in convenience samples recruited in the national GCPS reported injecting drugs in the last 6 months (Holt, Mao, Prestage, Zablotska, & de Wit, 2011).

Previous studies indicate that many GBM use amyl nitrite, methamphetamine (including crystal methamphetamine) and oral erectile dysfunction medications (EDM) (Prestage, 2009) to enhance sexual pleasure and performance (McCabe, Hughes, Bostwick, West, & Boyd, 2009; Prestage, Grierson, Bradley, Hurley, & Hudson, 2009). The GCPS was established in 1996 to monitor trends in sexual practices, drug use and testing practices related to HIV transmission among gay and other homosexually active men (Holt et al., 2016; Zablotska, Prestage, Middleton, Wilson, & Grulich, 2010). Questions about the sharing of injecting equipment are not routinely asked. In the 2004 Queensland GCPS, 95 respondents reported injecting drugs, of whom seven men (7.4%) had shared a needle or syringe in the previous six months (Hull et al., 2004). An online cross-sectional survey of 474 Australian GBM conducted in 2013 found that among the 15.0% of respondents who reported injecting drug use in the previous six months, 8.5% reported receptive syringe sharing (RSS) and 38.0% reported sharing ancillary injecting equipment (swabs, water ampoules) (Hopwood, Lea, & Aggleton, 2015). Unsafe injecting practices by GBM in the context of sex are of particular concern, because they may faciliate HIV transmission and, especially among men living with HIV, hepatitis C virus (HCV) transmission (Alter, 2007; Ghanem et al., 2011). Drug use has been implicated in HIV

transmission via its association with high-risk sexual practices, particularly condomless anal intercourse among GBM (Bolding, Hart, Sherr, & Elford, 2006; Buchacz et al., 2005; Difranceisco, Ostrow, & Chmiel, 1996; Koblin et al., 2003; McCabe et al., 2009; Prestage, 2009; Prestage, Grierson, et al., 2009; Rawstorne, Digiusto, Worth, & Zablotska, 2007; Rusch, Lampinen, Schilder, & Hogg, 2004; Solomon, Kiang, Halkitis, Moeller, & Pappas, 2010). In Australia, 3.8% of new HIV infections are estimated to be among GBM who inject drugs, although the exposure cannot be precisely determined as sexual or injecting (The Kirby Institute, 2015).

Despite the growing body of research on drug use among GBM, most studies of injecting drug use in this population have either been qualitative and thus unable to identify the correlates of injecting (Amaro, 2016; Dowsett, Wain, & Keys, 2005; Ellard, 2007; Slavin, 2004a, 2004b; Southgate & Hopwood, 1993, 2001) or have only collected incidental data about injecting. To better understand the factors associated with injecting drug use in this population and to elucidate their potential role in HIV and HCV transmission, we investigated the prevalence and correlates of recent injecting in a large prospective observational study specifically designed to examine drug use among GBM. Such findings will be of use to harm reduction, sexual health and gay men's community organisations as they target and tailor their interventions for this population.

METHODS

Data source and measures

The Following Lives Undergoing Change (FLUX) study is an ongoing online prospective observational cohort of Australian GBM which examines the prevalence and incidence of drug use and associated harms, and risk factors for uptake and changes in drug use over time. Baseline data were collected in 2014-2015 and the study protocol and procedure have been reported elsewhere (Hammoud et al., 2017). The study protocol was approved by the UNSW Human Research Ethics Committee (HC14075). Recruitment was conducted online using popular GBM 'dating' sites and apps, and Facebook and at gay community events to reach a diverse sample of GBM across Australia.

Potential participants were directed to the study website for enrolment, and were not offered incentives to enroll. Eligible participants were men who were aged 16.5 years or older, and who identified as gay/homosexual or bisexual, or reported sexual contact with another man at least once in the last 12 months. Among those who visited the study website, completed the online consent form, then fulfilled the minimum data requirements for the online questionnaire, we selected those men who responded to questions about illicit drug use.

A comprehensive self-completed questionnaire with approximately 200 questions was used to collect data on demographic characteristics; social and community engagement; HIV and HCV status; lifetime and recent (last six months) drug use (Degenhardt, Day, Gilmour, & Hall, 2005); pleasures and harms associated with drug use; sexual behaviour (Jin et al., 2009; Zablotska, Kippax, Grulich, Holt, & Prestage, 2011); stigma and mental health; attitudes to gay community and drug use; and access to and use of harm reduction resources.

Socio-demographic characteristics included traditional confounding factors such as age (categorised into age groups 31-50 and >50 versus $\leq$30), education level, employment status (full-time/part-time employed/student versus unemployed (including participants who reported being on social security), and sexual identification (gay/homosexual versus other). Measures of gay community engagement included scales measuring the extent of community engagement and types of engagement (Kippax et al., 1998), specifically engagement with gay friends and with gay friends who use drugs. The score on social engagement with gay friends (range: one to nine) was constructed as a sum of scores on two questions: 'How many of your friends are gay or homosexual men?' (A five-point Likert scale: 1- none; 2 - a few; 3 - some; 4 -most and 5 - all) and 'How much of your free time is spent with gay friends?' (A four-point Likert scale: 1 - none; 2 - a little; 3 - some and 4 - a lot). The score on social engagement with gay friends who use drugs was created using the same approach and questions 'What proportion of your current gay friends use drugs?' and 'How much of your free time is spent with gay friends who use drugs?' Mental health status, particularly depression and anxiety were measured using the Generalised Anxiety Disorder assessment scale (GAD7) (Spitzer, Kroenke,

Williams, & Lowe, 2006) and the Patient Health Questionnaire (PHQ9) (Kroenke, Spitzer, & Williams, 2001). A score of five or above was used to indicate a presence of depression or anxiety.

A list of ten psychoactive drugs was used to measure any use of each drug and lifetime and recent (in the last six months) injecting. This list included 'party drugs' (ecstasy, speed or methamphetamine (MA), crystal MA, cocaine, gamma-hydroxybutyrate (GHB), and ketamine (K)) and other drugs (heroin, lysergic acid diethylamide (LSD), marijuana and amyl nitrate). The concept of 'party drugs' reflects common usage within specific networks of gay men often referred to in the literature as club drugs or with respect to 'circuit parties' (Halkitis & Palamar, 2008; Halkitis, Palamar, & Mukherjee, 2007; Morgenstern et al., 2009; Pappas & Halkitis, 2011). Time since first party drug use was measured in years and calculated by subtracting the participant's age at first use of any party drug from their current age.

The following variables were assessed: number of sexual partners in the last six months (0-1 versus 2-10 and >10), condomless anal intercourse with casual partners (CLAI-C) in the last six months, group sex with casual partners in the last six months (including "randoms"), taking payment for sex (more than six months ago and in the last six months versus never) and sexual sensation-seeking. To assess CLAI-C, participants were asked if they had had sex with a casual partner in the previous six months, and then six questions about condom use in specific circumstances of positioning (receptive or insertive) and ejaculation inside the partner (yes versus no). Responses were then summarised in a dichotomous variable which measured any CLAI-C (yes if participants reported not using condoms on any of the six questions and no otherwise). Sexual sensation-seeking was measured on an 11-item sensation-seeking scale (Kalichman, Heckman, & Kelly, 1996), which assessed the propensity to seek out exciting and novel sexual experiences. Each item was measured on a 4-point Likert scale, ranging from one ('not at all like me') to four ('very much like me'). Item scores were summed up (range: 11-44), with higher scores indicating greater sexual sensation-seeking

Data analyses

This analysis includes 1,995 participants who completed the Phase 1 baseline survey and provided sufficient data about drug use. The outcome of interest is recent injecting drug use defined as any injection drug use in the last six months. We use 'recent injectors' to refer to men who reported recent injecting and 'other participants' to refer to all others, including those who reported never injecting and those who had injected more than six months ago. Independent variables included demographic characteristics, social factors, drug use factors, sexual practices and other factors described above. Associations were initially assessed using Pearson's χ^2test for independence. Because the outcome of interest – recent injecting drug use - was a binary variable with log-binomial distribution, we used log-binomial regression methods with a Type I error of 5%. Variables significantly associated with the outcome of interest in unadjusted regression models were included in multivariate analyses. Forward step-wise regression was used to successively add groups of related variables to a final multivariate model.

Previously White et al. reported an association between dropping out of school and recent drug injection (White et al., 2006). We also investigated the interaction of age and education and their combined relationship with injecting. For this purpose, a composite variable of age and education was created and included in the multiple regression models. Self-reported HIV and HCV status were not included in the final regression model due to their correlations with high-risk sexual practices and bi-directional relationship with the outcome of interest. We report unadjusted and adjusted prevalence ratios (PRs) with associated 95% Confidence Intervals (95% CI) for all associations of interest examined here. All analyses were conducted in Stata 14.0 (College Station, Texas 77845 USA).

RESULTS

Between August 2014 and July 2015 2,943 men consented to participate, 2,705 commenced the baseline survey and 2,250 fulfilled the minimum data requirements. We excluded 255 participants who did not provide sufficient information about drug use. Compared to the 1,995 men included here,

the 255 men excluded were older (mean age of 36.1 vs 32.6; p <0.001), more likely to be social engaged with gay friends (mean score of 5.6 vs 5.4; p =0.032), more likely to be living with HIV (12.9 % vs. 6.9 %; p <0.001) and have greater sexual sensation seeking (mean score of 30.2 vs. 29.0; p =0.017), but were otherwise similar.

Most participants (88.6%) identified as gay or homosexual (Table 1). The mean age was 32.6 years (SD=12.6, range: 16.5-81) and more than half (52.2%) had completed at least one university degree. One in ten men (9.9% of the sample) were unemployed or in receipt of social security, 6.9% self-reported as living with HIV and 1.9% reported ever being diagnosed with hepatitis C virus (HCV) infection. Mean scores on scales of social engagement with gay friends, including those who used drugs, were 5.4 (SD=1.7) and 3.8 (SD=2.2). Almost one third (32.3%) spent all or most of their free time with gay friends and one in five (19.9%) reported spending all or most of their free time with gay friends who use drugs. Just over half (55.8%) met the criteria for depression and 42.5% met the criteria for anxiety.

Prevalence of lifetime injecting was 10.3% and prevalence of recent injecting was 4.7% (Table 2). Participants who recently injected drugs were more likely than other participants to be older (mean age 39.4 vs. 32.3 years; p <0.001) and socially engaged with gay men (mean score of 5.8 vs. 5.4, p =0.021) and specifically, gay men who inject drugs (mean score of 5.5 vs. 3.8, p <0.001). Recent injectors were more than twice as likely as other participants to report that at least half of their gay friends used drugs (67.7% vs. 30.6%, p <0.001). The prevalence of HIV infection among recent injectors was almost 10-fold higher than among other participants (46.2% vs. 5.0%, p <0.001).

[Table 1 & 2 should be near here]

Among men who had ever injected but who had not injected in the last six months, speed was the most commonly injected drug (89.0%). Among men who had recently injected drugs, crystal was the drug most commonly injected (91.4%). One in six recent injectors (17.2%) reported injecting drugs at least weekly and 43.0% at least monthly. Among men who had ever used illicit drugs, participants

who had recently injected drugs reported a higher mean number of drugs ever used compared to participants who had not injected drugs recently (M=8.0, SD=1.4 vs. M=4.2, SD=2.8, p <0.001). The average time since the first use of party drugs was 17.3 years (SD=9.3) for recent injectors and 8.4 (SD=9.6) for other participants with a history of drug use. Participants who had recently injected drugs most commonly reported that they obtained injecting equipment from needle and syringe programs (40.9%), sex partners (33.3%) and community pharmacies (31.2%). Almost one in ten (8.6%) recent injectors reported receptive syringe sharing (RSS) in the last six months; all but one reported always sterilising syringes before re-using them.

Injecting frequently took place in the context of sex with 91.4% of recent injectors reporting injecting at least once before or during sex in the last six months. When asked about reasons for crystal use by any route of administration, participants who had recently injected were significantly more likely than other participants to report using crystal because it would 'Make it easier for me to get fucked' (31.8% vs. 13.1%, p <0.001), 'To help me have sex for longer' (40.0% vs. 19.4%, p <0.001), 'To become less inhibited' (60.2% vs. 27.1%, p <0.001), 'For a party and play (PNP) session' (80.7% vs. 39.1%, p <0.001) and 'To party for a long time' (56.8% vs. 34.8%, p <0.001). When compared with men who did not inject drugs in the last six months, significantly fewer participants who recently injected drugs reported having one or no sex partners in the last six months (1.1% vs. 32.7%, p <0.001) and more reported having ten or more sex partners (57% vs. 24.3%, p <0.001). Similarly, practices such as recent group sex (62.4% vs. 23.1%, p <0.001), CLAI-C (73.1% vs. 25.3%, p =0.001) and taking payment for sex more than six months ago and in the last six months (28.0% vs. 10.2% and 14.0% vs. 5.8% respectively; p <0.001) were also more common in men who recently injected drugs than men who had not. Finally, levels of sexual sensation-seeking were higher among men who had injected recently than among other participants (mean score of 33.4 vs. 28.8, p <0.001).

[Table 3 should be near here]

Table 4 presents the results of regression analyses. In the final multivariate regression model, factors significantly associated with recent injecting were time since initiating party drug use (APR=1.02,

95% CI 1.01-1.04), number of drugs ever used (APR=1.31, 95% CI 1.21-1.41), having multiple sex partners (men with 2-10 partners: APR=3.44, 95% CI 1.45-8.20 and >10 partners: APR=3.21, 95% CI 1.30-7.92 compared with men who had no partners or only one partner), engaging in group sex with casual sex partners (APR=1.42, 95% CI 1.05-1.91) and CLAI-C (APR=1.81, 95% CI 1.34-2.43). The odds of injecting among GBM men increased 2.0% with each year since initiating party drug use, and 31.0% with each additional illicit drug ever used.

The sexual sensation-seeking score was associated with injecting in unadjusted analysis (PR=1.06, 95% CI 1.04-1.08), but was excluded from the final model due to its correlation with the number of sex partners. In addition, in bivariate analyses we observed three additional factors that were associated with recent injecting: GBM who did not complete high school and who were 31-50 years old were more likely to report recent injection drug use than those aged $\leq$ 30 years (PR=1.54, 95% CI 1.12-2.11), as were GBM who scored higher on social engagement with gay friends and with gay friends who use drugs. However, after adjusting for confounding in the final regression model, these factors were no longer associated with recent injecting.

[Table 4 should be near here]

DISCUSSION

Prevalence of recent injecting in our study (4.7%) was similar to that reported by GBM in Sydney in the 2015 GCPS (4.6%) (Hull et al., 2015). However, both estimates are higher than in the general Australian population (0.3%) (Australian Institute of Health and Welfare, 2014). Injecting was most common among recent crystal users (17.2%), a finding similar to that reported by the GCPS. In contrast, opioids are the most commonly injected drugs among the predominantly heterosexual injectors attending needle and syringe programs (NSP) throughout Australia (Memedovic, Iversen, Geddes, & Maher, 2016). However, prevalence of crystal injection among recent injectors in the FLUX study was higher than that reported in the 2004-2006 GCPS (91.4% vs 51.8% (Lea, Mao, et al., 2013) respectively). Although the GCPS did not specifically collect information about crystal

injecting after 2006, there was a significant increase in injecting of any drug among crystal users during the ten-year period from 2005 to 2014 (from 18.7% to 28.7%; p-trend <0.001) (Lea et al., 2016).

Prevalence of injecting risk behaviour was high in the current study, with almost one in ten GBM reporting RSS in the last six months, but not as high as the 16.0% in the last month reported in the 2015 Australian Needle and Syringe Program Survey (Memedovic, Iversen, Geddes, & Maher, 2016). While NSPs have been operational in Australia since 1987, resulting in high coverage of injections with sterile syringes (Iversen, Topp, Wand, & Maher, 2012; Iversen, Linsen, Kwon, & Maher, 2017) coverage may be uneven and some groups may experience ongoing barriers to access and availability. Encouragingly, some Australian gay community organisations, such as ACON, operate NSPs and conduct health promotion activities with a focus on harm reduction and safe injecting practices (AIDS Council of New South Wales Inc (ACON), 1991). It is worth noting that nearly all of our participants who reported RSS also reported sterilising syringes prior to re-use, potentially indicating a need for more precise harm minimisation messages for GBM. Further research is also necessary to explore what is meant by sterilisation in this context.

Previous research has suggested that drug use among GBM may be explained by cultural norms around sexual relationships and practices which are sustained among socially engaged GBM (Amaro, 2016; Southgate & Hopwood, 2001). One Australian study (Slavin, 2004a) found that injecting drug use fostered a sense of belonging to gay community among some gay men. While men who had recently injected in the current study were twice as likely to have gay friends who used drugs, social engagement with gay friends, including those who used drugs, was not independently associated with recent injecting.

Our participants reported primarily injecting drugs in the context of sex, to enhance sexual pleasure and improve sexual performance, a practice described as ‘intensive sex partying’ (Hurley & Prestage, 2009). Recent injecting was independently associated with having had multiple sex partners, engaging

in CLAI-C and group sex with casual partners in the recent six months - practices well known to be associated with HIV transmission among GBM (Buchacz et al., 2005; Elford, 2006; Fisher, Reynolds, & Napper, 2010; Jin et al., 2009; Prestage, Jin, et al., 2009; Zablotska et al., 2010). Even when adjusted for engagement in group sex, men who had multiple sex partners in the preceding six months had three times the odds of reporting recent injecting compared to men who had one or no sex partners. Men who reported no recent sex and men who reported sex with only one partner (i.e. those likely to be in a monogamous relationship) were similar in that neither group tend to be actively seeking sex with someone else, and thus were less likely to inject to enhance sexual pleasure. The increased likelihood of injecting, particularly in the context of sexual pleasure, suggests the potential contribution of injecting, both direct and indirect, via associated sexual practices, to the transmission of HIV and HCV among GBM. Exposure to HIV and HCV through condomless anal intercourse, particularly with casual partners, may be mediated by sexual disinhibition related to the effects of drug, particularly methamphetamine use. Given that the men in our study primarily reported using the drugs they injected in order to enhance their sexual experiences they are most likely aware of the potentially increased risk this entails.

HIV and HCV prevention interventions for this population need to target GBM who engage in both high-risk sexual behaviour and drug injection in the context of sex. For these interventions to be successful, a close link to, or the integration of, NSPs into HIV prevention and sexual health services for GBM is essential. There is also a need for targeted interventions such as the safe sex party packs (consisting of condoms, gloves, silicon lubricant, cock rings, tips and information on how to make partying safe and fun, and emergency contact numbers) distributed by ACON in NSW designed for men who are planning sex parties. While the integration of NSP into sex party outreach work may also be a useful strategy, there is also a need for mainstream NSPs to better meet the needs of GBM who inject drugs. Ideally this should be informed by research designed to explore the knowledge and practices of GBM who inject drugs and how they manage injection-related harm reduction in sexual contexts.

Our findings are consistent with, and expand on, those from previous research among GBM who use drugs in Australia (Van de Ven, Kippax, Crawford, & Rodden, 1999) and help to identify an important target population for harm reduction and health promotion interventions. A related publication from the Flux study which compared GBM who reported concurrent use of methamphetamine, Truvada and Viagra (MTV) with those who reported methamphetamine and Viagra, but not PrEP, found that MTV use was associated with higher risk sexual practices and greater social connections with gay community. While this work illustrates the complex negotiations between attempts to simultaneously reduce HIV risk and enhance sexual pleasure within gay sexual subcultures, it also highlights the need for harm reduction initiatives targeting GBM who engage in intensive sex partying (Hammoud et al., submitted). In relation to injecting drug use, we found that GBM with longer histories of party drug use and those who reported using a greater number of drugs over the lifetime were more likely to be recent injectors. Little is known about transitions from non-injecting to injecting routes of administration and the drivers and circumstances surrounding the initiation of injection among GBM. In the absence of this information and the lack of evidence-based interventions designed to prevent transitions to injecting by drug users, identifying GBM at risk of injection and preventing transitions remains ethically and empirically fraught (Swift, Maher, & Sunjic, 1999). It is therefore important that GBM who are transitioning to injecting drug use are equipped with accurate information to ensure initiation into safe injecting practices.

Our analysis also revealed that GBM who did not complete high school and were 31-50 years old were more likely to report recent injecting compared to those who completed high-school. This finding is consistent with previous studies which have reported strong associations between dropping out of school and injecting drug use (White et al., 2006). The data presented here suggest a need to identify appropriate mechanisms and target this group of GBM with interventions promoting safer sex and injecting practices.

Our study has limitations. Data were self-reported and vulnerable to misreporting and social-desirability bias. Missing responses to some questions of interest limited our analysis – for example,

missing data on the sexual sensation seeking scale (> 10%) precluded the investigation of sensation seeking in multivariate analyses. There is also the possibility of recall bias, which we tried to limit by restricting our outcome to injecting in the last six months. Our comparison using a dichotomous variable of recent injectors versus others possibly resulted in underestimated associations of interest. Despite these limitations, the data presented here are valuable because they come from the first study in Australia to recruit a cohort of GBM entirely online to focus on drug use. The online space creates comfortable conditions for participants to disclose drug use in the context of sex without judgement. And while online enrolment might have not reached GBM who do not use the internet, potentially threatening external validity, the characteristics of our sample are similar to samples of Australian GBM recruited by time-location sampling and therefore valid for comparisons with, and generalisable to, socially engaged GBM (Lea, Prestage, et al., 2013; Prestage, Jin, et al., 2009; Zablotska, Holt, & Prestage, 2012).

CONCLUSIONS

Our findings confirm that the prevalence of lifetime injecting drug use among Australian GBM (10.3%) is high, with 4.7% reporting injecting in the last six months. Recent injecting was independently associated with high-risk sexual practices such as having multiple sex partners, having group sex with casual partners and recent CLAI-C. While in the Australian context, unsafe sexual practices are the major contributor to HIV transmission among GBM, the potential contribution of injection drug use to unsafe sexual practices that drive transmission should not be overlooked. Our data suggest a need for interventions targeting GBM who inject drugs to enhance sexual pleasure and performance and engage in high-risk sexual behaviour. These results highlight the synergies between injecting drug use and high-risk sexual behaviour among GBM, indicating a need for integrated combination harm reduction interventions (Burgos et al., 2012; El-Bassel & Strathdee, 2015; Strathdee et al., 2013) for GBM who inject methamphetamine in both sexual health services and NSPs.

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Conflict of Interest Statement

No potential conflicts of interest were reported by the authors.

Table 1: Characteristics of FLUX study participants at baseline (n=1,995)

Characteristic	Overall (n= 1,995)	Did not inject drugs in the last 6 months (Other participants) (n = 1,902)	Injected drugs in the last 6 months (Recent injectors) (n = 93)	Test statistics for comparison of groups[1] (p-value)
	%	%	%	
DEMOGRAPHIC FACTORS				
Age				
Mean ± SD[2]	32.6±12.6	32.3 ± 12.6	39.4 ± 10.1	-6.443 (<0.001)
≤30	53.7	55.4	20.4	54.485 (<0.001)
31-50	34.9	33.2	69.9	
>50	11.3	11.4	9.7	
Education and age[6]				
Incomplete HS/TC[3], including:	24.8	24.3	34.4	24.157 (<0.001)
- men aged ≤30	12.8	1.30	8.6	
- men aged 31-50	8.5	7.9	21.5	
- men aged >50	3.5	3.4	4.3	
High school	22.7	23.0	17.2	
Undergraduate	31.2	31.5	24.7	
Post graduate	21	20.9	23.7	
Employment[6]				
FT/PT[4] employed, student	89.2	89.6	81.7	5.955 (0.051)
Unemployed/ on social security	9.9	9.5	17.2	
Sexual identification				
Gay/homosexual	88.6	88.5	90.3	0.280 (0.597)
Other [5]	11.4	11.5	9.7	
SOCIAL FACTORS				
Social engagement with gay friends (scale; 1-9)[6]				
Mean ± SD	5.4 ± 1.7	5.4 ± 1.7	5.8 ± 1.7	-2.309 (0.021)
Proportion of gay friends who use drugs				
None	24.8	25.7	6.5	57.976 (<0.001)
A few	42.7	43.5	25.8	
About half and more	32.3	30.6	67.7	
Free time spent with gay friend who use drugs				
None	41.1	42.6	10.8	50.262 (<0.001)
A little	38.4	38.0	46.2	
Some/ A lot	19.9	18.8	43.0	

[1] We used χ^2test for independence when comparing sample proportions and t-test when comparing means.
[2] SD – standard deviation
[3] HS - High school, TC - Trade certificate
[4] FT – full-time, PT – part-time
[5] Including men who identified as bisexual
[6] Less than 1% missing value

Social engagement with gay friends who use drugs (scale; 1-9)[7]				
Mean ± SD	3.8 ± 2.2	3.8 ± 2.2	5.5 ± 1.8	-7.787 (<0.001)
MENTAL HEALTH FACTORS				
Depression status (based on PHQ-9 score)[8]				
No	44.2	44.6	44.3	0.004 (0.952)
Yes	55.8	55.4	55.7	
Anxiety status (based on GAD-7 score)[8]				
No	57.5	54.7	57.4	0.27 (0.603)
Yes	42.5	45.4	42.6	
OTHER FACTORS				
HIV status				
Negative or unknown	93.1	95.0	53.8	234.218 (<0.001)
Positive	6.9	5.0	46.2	
Ever diagnosed with Hepatitis C virus infection				
No	98.1	99.8	85.9	109.195 (<0.001)
Yes	1.9	1.2	16.1	
Lifetime imprisonment[7]				
No	96.0	98.7	96.8	3.646 (0.162)
Yes	1.4	1.3	3.2	

[7] 1%-5% missing value
[8] 5%-10% missing value

Table 2: Prevalence of injecting drug use at baseline in the FLUX study (n=1,995)

Name of the drug	Never injected	Injected more than 6 months ago	Injected the drug in the last 6 months
	N (%)	N (%)	N (%)
Crystal	1,849 (92.7)	61 (3.1)	85 (4.3)
Speed	1,885 (94.5)	101 (5.0)	9 (0.5)
Cocaine	1,947 (97.6)	43 (2.1)	5 (0.3)
Ketamine	1,960 (98.2)	29 (1.5)	6 (0.3)
Heroin	1,950 (97.8)	41 (2.1)	4 (0.2)
Ecstasy	1,950 (97.7)	44 (2.2)	1 (0.1)
LSD[1]	1,987 (99.6)	7 (0.3)	1 (0.1)
GHB[2]	1,995 (100)	0 (0.0)	0 (0.0)
Marijuana	1,995 (100)	0 (0.0)	0 (0.0)
Amyl	1,995 (100)	0 (0.0)	0 (0.0)
Any drug	1,789 (89.7)	113 (5.6)	93 (4.7)

[1] Lysergic acid diethylamide
[2] Gamma-hydroxybutyrate

Table 3: Drug use and sexual risk behaviours at baseline in the FLUX study (n=1995)

	Overall (n=1995)	Did not inject drugs in the last 6 months (Other participants) (n = 1902)	Injected drugs in the last 6 months (Recent injectors) (n = 93)	Test statistics for comparison of groups[1] (p-value)
Time since initiating party use (years)[3]				
Mean ± SD	7.1 ± 9.5	6.5 ± 9.2	17.3 ± 9.3	-10.927 (< 0.001)
Number of illicit drugs ever used				
Mean ± SD	3.5 ± 3.2	3.3 ± 3.1	8.0 ± 1.4	-12.68 (<0.001)
Ever used crystal monthly or more frequently				
No	88.6	91.8	23.7	408.282(<0.001)
Yes	11.4	8.2	76.3	
Enjoyed being wired when party and play in the last 6 months				
No	77.1	80.6	7.4	278.799 (<0.001)
Yes	22.9	19.4	93.6	
Number of sex partners in the last 6 months[4]				
0-1	31.2	32.7	1.1	65.173 (<0.001)
2-10	40.2	40.2	38.7	
More than 10	25.8	24.3	57.0	
Recently in relationship with main partner				
No	64.8	64.6	68.8	0.703 (0.402)
Yes	35.2	35.4	31.2	
Group sex with casual partners in the last 6 months[4]				
No	71	72.9	33.3	74.454 (<0.001)
Yes	24.9	23.1	62.4	
CLAI-C[2] in the last 6 months				
No	72.5	74.7	26.9	101.691 (<0.001)
Yes	27.5	25.3	73.1	
Received payment for sex[4]				
Never	79.6	80.9	53.8	43.620 (<0.001)
> 6 months ago	11.0	10.2	28.0	
In the last 6 months	6.2	5.8	14.0	

[1] We used χ^2test for independence when comparing sample proportions and t-test when comparing means.
[2] Condomless anal intercourse with casual partners
[3] Less than 1% missing value
[4] 1%-5% missing value

Sexual sensation-seeking (scale; 11-44)[5]				
Mean ± SD	29 ± 6.4	28.8 ± 6.4	33.4 ± 5.4	-6.545 (<0.001)

[5]10-15% missing value

Table 4: Relationships between socio-demographic characteristics, drug use and sexual behaviour and injecting drug use among FLUX study participants

	row N	% reported injecting drugs	Unadjusted Prevalence Ratio (95% CI)	Adjusted Prevalence Ratio (95% CI)
Total sample	**1,995**	**4.7**		
DEMOGRAPHIC FACTORS				
Age				
≤30	1,072	1.8	1.0	
31-50	697	9.3	**2.18 (1.75-2.73)**	
>50	226	4.0	1.42 (1.00-2.01)	
Education and age[4]				
Incomplete HS/TC[1] including:				
- men aged ≤30	256	3.1	0.78 (0.55-1.13)	1.52 (0.90-2.58)
- men aged 31-50	170	11.8	**1.54 (1.12-2.11)**	1.29 (0.84-2.01)
- men aged >50	68	5.9	1.06 (0.63–1.78)	1.17 (0.56-2.43)
High school	453	3.5	0.83 (0.62-1.11)	0.98 (0.64-1.49)
Undergraduate	622	3.7	0.85 (0.65-1.11)	0.92 (0.63-1.32)
Post graduate	419	5.3	1.0	1.0
Employment[1]				
FT/PT[2] employed, students students	1,780	4.3	1.0	
Unemployment/on social security[3]	197	8.1	**1.38 (1.05-1.82)**	
SOCIAL FACTORS				
Social engagement with gay friends (scale: 1-9)[4]	1,995	4.7	**1.07 (1.01-1.13)**	0.92 (0.83-1.01)
Social engagement with gay friends who use drugs (scale: 1-9)[5]	1,995	4.7	**1.19 (1.14-1.26)**	1.03 (0.95-1.12)
DRUG USE				
Time since initiating party drug use (years)[4]	1,995	4.7	**1.04 (1.03-1.05)**	**1.02 (1.01-1.04)**
Number of drugs ever used (0-10)	1,995	4.7	**1.34 (1.27-1.42)**	**1.31 (1.21-1.41)**
SEXUAL BEHAVIOUR				
Number of sex partners in the last 6 months[5]				
0-1	622	0.2	1.0	1.0
2-10	801	4.5	**3.49 (1.87-6.52)**	**3.44 (1.45-8.20)**
More than 10	515	10.3	**5.37 (2.88-10.02)**	**3.21 (1.30-7.92)**
Recently in relationship with main partner				

[1] HS - High school, TC - Trade certificate
[2] FT – full-time, PT – part-time
[3] Despite of significant association with the outcome of interest, variable was not included in the final regression due to early loss of significant in the first step of selected model within the demographic factors
[4] Less than 1% missing value
[5] 1%-5% missing value

No	1,292	5.0	1.0	
Yes	703	4.1	0.92 (0.75-1.12)	
Group sex with casual partners in the last 6 months[5]				
No	1,417	2.2	1.0	1.0
Yes	497	11.7	**2.28 (1.86-2.80)**	**1.42 (1.05-1.91)**
CLAI-C[1] **in the last 6 months**				
No	1,446	1.7	1.0	1.0
Yes	549	12.4	**2.60 (2.12-3.20)**	**1.81 (1.34-2.43)**
Received payment for sex[2, 5]				
Never	1,558	3.2	1.0	
>6 months ago	219	11.9	**1.97 (1.54-2.52)** [a]	
In the last 6 months	124	10.5	**1.83 (1.33-2.52)**	
Sexual sensation-seeking (scale: 11-44)[7]	1,777	4.7	**1.06 (1.04-1.08)**[b]	
MENTAL HEALTH FACTORS				
Depression status (based on PHQ-9 score)[6]				
No	805	4.6	1.0	
Yes	1,014	4.5	0.99 (0.81-1.21)	
Anxiety status (based on GAD-7 score)[6]				
No	1,037	4.5	1.0	
Yes	771	5.1	1.05 (0.86-1.28)	
OTHER FACTORS				
HIV status[3]				
Negative or unknown	1,857	2.7	1.0	
Positive	138	31.2	**4.21 (3.28-5.39)**	
Ever diagnosed with HCV[3]				
No	1,958	4.0	1.0	
Yes	37	40.5	**4.54 (2.98-6.91)**	
Lifetime imprisonment[2]				
No	1,915	4.5	1.0	
Yes	27	11.1	1.61 (0.85-3.03)	

[1] Condomless anal intercourse with casual partners

[2] Variable was not included in the final regression model due to the interaction with 'number of sex partners'

[3] Variable was not included in the final regression model due to bi-directed correlation with the outcome of interested

[5] 1%-5% missing value

[6] 5%-10% missing value

[7] 10-15% missing value